REMARKS

This Reply is responsive to the Office Action dated June 23, 2006. In the Office Action all twelve (12) claims were rejected based on either published US Patent Application No. 2004/0178766 to Bucur (Bucur) or US Patent No. 6,329,796 to Popescu (Popescu).

In this Reply, claims 1-3, 6-9 have been amended and new claims 13 and 14 added. No new matter has been added.

As amended, the respective independent adapter interface claims 1 and 7 have been amended to recite "a second DC path coupled to said first DC path including a DC-DC converter therein for providing battery charging current for charging said battery".

Applicants will first review amended claim 7 to demonstrate support for claim amendments provided herewith and to point out salient inventive features. Amended claim 7 includes all limitations of claim 1 as amended, as well as several other limitations. Accordingly, amended claim 7 will be reviewed below.

As amended, claim 7 recites (Additions shown underlined):

7. (Currently amended) A DC power interface, comprising:

a first DC path for supplying DC power from a DC power source to a utility device, and a second DC path for charging a battery that can be used for powering said utility device;

an input port that is adapted to be coupled to said DC power source,

a current sensor in series with said input port for measuring a total current flow through said first DC path supplied by said DC source, said total current including load current for said utility device and charging current for said battery;

a first output port that is adapted to be coupled to said utility device and is coupled to said ~~first~~ input port by way of said first DC path;

a second output port that is adapted to be coupled to said battery and to said second DC path;

a battery charging circuit comprising a DC-DC converter including a pulse width modulator, said modulator having at least one control input, said battery charging circuit coupled to said first DC path and being operative to generate said charging current into said second output port for charging said battery; and

a control circuit including a sense amplifier for monitoring said total current flow and generating a measured voltage at its output relating to said total current flow, and structure for generating a current limit representative voltage, and

at least one response loop for receiving said measured voltage and said current limit representative voltage, an output of said response loop coupled to said control input, wherein an amount of said battery charging current supplied by said battery charging circuit is reduced in response to said total current flow exceeding a prescribed threshold current limit.

Support for the above claim amendment is throughout the present specification, but is most easily identified in Fig. 1 and its corresponding specification teaching. The claimed "current sensor in series with said input port for measuring a total current flow through said first DC path supplied by said DC source, said total current including load current for said utility device and charging current for said battery" is shown in Fig. 1 as current demand sense resistor 20, which develops a voltage across it from the total current provided by the AC adaptor shown. The battery charging circuit "comprising a DC-DC converter including a pulse width modulator, said modulator having a control input" is shown in Fig. 1 as pulse width modulator 90 and duty cycle control input 91. The claimed control circuit "including a sense amplifier for monitoring current flow and generating a measured voltage at its output relating to said current flow" is shown in Fig. 1 as current sense amplifier 30. The claimed "structure for generating a current limit representative voltage" is shown in Fig. 1 primarily as current source 80, voltage divider 60 and current limit setting resistor 70, and is described in paragraph 18 (copied below):

For this purpose, overcurrent comparator 40 has a second, inverting (-) input coupled to a first end 61 of a voltage divider 60, which is comprised of resistors 62 and 63 that are connected in series between an adapter current limit pin ACLIM and ground. The first end 61 of the voltage divider 60 is coupled to the pin ACLIM. The ACLIM pin is coupled to a current limit setting resistor 70 which is referenced to ground. A current source 80 is coupled to the ACLIM pin and supplies a prescribed reference current to the current limit setting resistor 70, in order to generate a predetermined reference voltage across the current limit setting resistor 70 that is representative of the target current limit of the AC-DC adapter. This reference voltage is divided by the voltage dividing resistor pair 62-63 and applied to the non-inverting (+) input 52 of battery charger error amplifier 50. Similarly, a current source 82 supplies a bias current to the series resistor-capacitor connection to the COMP pin.

Support for "at least one response loop for receiving said measured voltage and said current limit representative voltage, an output of said response loop coupled to said control input, wherein an amount of said battery charging current supplied by said battery charging circuit is reduced in response to said total current flow exceeding a prescribed threshold current limit" can be found again in Fig. 1. The response loop feature is described below in paragraph 21, (copied below) which describes two separate throttling loops (a fast loop including one shot 45 and a slow loop including error amplifier 50), both coupled to duty cycle control input 91 of PWM 90.

The output 53 of error amplifier 50 is coupled to a compensation pin COMP, which is referenced to ground through a resistor 72 and a capacitor 74. The compensation pin COMP is coupled to the duty cycle control input 91 of pulse width modulator (PWM) 90. Error amplifier 50 drives a first relatively slow analog throttling loop operating in a conventional manner to gradually adjust the duty cycle of PWM 90 for changes in adapter current relative to that set by the current limit resistor 70. On the other hand, as pointed out above, in accordance with the invention, overcurrent amplifier 40 drives a non-conventional, relatively fast charging current throttling loop, being tripped in response to a prescribed excess in adapter current flow (e.g., 120% overcurrent). This triggers a one-shot 45, which disables the operation of PWM 90, for a prescribed period of time (e.g., on the order of thirty microseconds), so as to interrupt the flow of charging current produced by a buck mode converter 100 of conventional construction, which is driven by the PWM 90, which serves as the battery charging supply.

New claims 13 and 14 relating to first (faster) and second (slower) response loops are supported by FIG. 1 and the paragraph above.

The reduction in current triggered can be based on an interruption (cutoff) or simply a reduction (battery charging continues, albeit at a slower rate) in current. Fig. 2 and its associated specification (paragraph 29 and 30) discloses the reduction embodiment recited in the alternative in amended claim 2 ("interrupt or reduce current drawn"). Amended claim 8 recites the fast response loop feature of the present invention ("wherein said response loop comprises an overcurrent comparator an output of said overcurrent comparator coupled to a one-shot, said one shot coupled to said control input, wherein said one shot produces an output pulse that causes a reduction in the duty cycle of said pulse width modulator, in response to said total current flow exceeding said prescribed threshold". Accordingly, no new matter has been added.

Turning now to the cited art, According to the Examiner:

> Claims 1-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Bucur et al. (US 2004/0178766). The reference discloses a power management system having, *inter alia*, a controllable ac/dc power source 104 delivering power to charge a battery 105 and simultaneously to power a system load 110. To prevent overloading the adapter 104, the charging current is reduced. See paragraph 0076.
>
> Claims 1-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Popescu (US 6,329,796). This reference also discloses a power management circuit for powering both a load and recharging a battery wherein the current to the battery is reduced to prevent overloading.

Bucur discloses a wake up circuit according to one embodiment includes a comparison circuit and an output decision circuit. The comparison circuit may be adapted to receive a first signal representative of a charging current level provided to a battery via a path and a second signal representative of a predetermined wake up current level and to provide a comparison output signal in response to the first and second signal. The output decision circuit may be adapted to receive at least the comparison output signal and a selector signal from a selector circuit, the output decision circuit providing one of the

comparison output signal and the selector signal to a switch to control a state of the switch, the switch coupled to the path.

Bucur in all disclosed embodiments has the system bus and battery separated by at most a switch. For example, the first paragraph (paragraph 26) of Bucur's detailed description the following is disclosed:

FIG. 1 illustrates a simplified block diagram of an electronic device 100 having a system load 110 capable of being powered by a controllable DC power source 104, a battery 105, or by both in parallel as the need arises as further detailed herein. A table 180 showing the position of switches SW1 and SW2 in various power supply modes is also illustrated. In one embodiment, the controllable DC power source 104 may be a controllable adapter as further detailed herein, e.g., an ACDC adapter, that provides the only power conversion necessary to deliver power to the system load 110 and the battery 105. *As such, the need for an additional power conversion step (e.g., a DC to DC converter to provide a finely controlled output to the battery for charging) typically utilized in other power supply systems is obviated in this instance.*

Here, the battery 105 is separated from the system bus 114 by only SW2. Thus, Bucur does not disclose or suggest Applicants' claimed DC-DC converter disposed between the system bus and battery. In fact, the last sentence of paragraph 26 italicized above teaches away from adding Applicants' claimed DC-DC converter (*"As such, the need for an additional power conversion step (e.g., a DC to DC converter to provide a finely controlled output to the battery for charging) typically utilized in other power supply systems is obviated in this instance")*

Paragraph 76 cited by the Examiner again refers to FIG. 1 and does not disclose or suggest Applicants' claimed DC-DC converter in the path between the system bus and the battery.

Popescu discloses a power management circuit for battery systems composed of a switch defining a single charge/discharge path. The switch is selectively controlled using

analog signals to couple a battery to a power source for charging, or to couple the battery to an active load. For charging, the switch is controlled by a controller circuit that monitors the battery voltage, the power source and the individual battery cells. The battery is only coupled to the power source if it is determined that the power source is present and that each of the battery cells is capable of receiving a charge. During discharge, the controller monitors the discharge current from the battery and compares this value to a threshold current. If the discharge current falls below the threshold, the switch is controlled to decouple the battery from the load. In this way, an overcharge condition is avoided if, for example, a power source is reapplied to the system. In a multiple battery system (where the battery and battery circuits are connected in parallel to a load and a power source), the use of the threshold current prevents a cross-conduction between batteries.

Popescu has little relevance to the presently claimed invention. Popescu is mostly concerned with the architecture of the battery pack with an on-board charger. Popescu does not disclose measuring the current provided by the DC source (e.g. AC/DC adaptor) or throttling back charging in response to the current level provided by the DC source. Moreover, like Bucur, Popescu does not disclose or suggest Applicants' claimed DC-DC converter in the path between the system bus and the battery.

Accordingly, independent claims 1, 7 , 9 and their respective dependent claims (at least based on their dependency) are allowable claims. Applicants note that certain dependent claims provide independent bases for patentability. For example, claims 13 and 14 are drawn to a DC power interface having a first and a second response loop having different response times. Claim 14 defines the first loop as a fast loop having an

overcurrent amplifier which triggers a one-shot which is coupled to the control input of the PWM. Multiple response loops, and particularly Applicants' claimed fast loop are not disclosed or suggested in the art of record.

Applicants have made every effort to present claims which distinguish over the cited art, and it is believed that all claims are now in condition for allowance. However, Applicants request that the Examiner please call the undersigned (Direct line 561-671-3662) if anything further is required by the Examiner prior to issuance of a Notice of Allowance for all claims.

No fee is believed due related to the filing of this Reply. However, if any fee is due, the Commissioner is authorized to charge any such fee and any additional fees due or credit any overpayment to Deposit Account No. 50-0951.

Respectfully submitted,

Date: 9/25/06

Neil R. Jetter, Reg. No. 46,803
AKERMAN SENTERFITT
222 Lakeview Avenue; Suite 400
P.O. Box 3188
West Palm Beach, FL 33402-3188
(561) 653-5000

Docket No. 7302-17